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**COMPLETE SPECIFICATION**

FOR A STANDARD PATENT

**ORIGINAL**

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The following statement is a full description of this invention, including the best method of performing it known to me/us:-

## Abstract

### PRINTING APPARATUS

5 Printing apparatus (1) is disclosed comprising a elongate hand-held body (2) and an electronically controllable print head (6) mounted on or in the body for directing printing material onto a surface when the print head is brought adjacent thereto. A position  
10 sensing means (17) is provided for detecting movement of the body relative to the surface and image supply means (14) for supplying image data of an image to be printed on the surface. As the body is moved relative to the surface, the print head directs the printing material onto the surface in accordance with the image data.



## PRINTING APPARATUS

### Field of Invention

The present invention relates generally to printing apparatus 1s and, in particular, to a hand-held printing apparatus 1 capable of printing directly onto a surface in accordance with predetermined image data. The invention has been developed primarily for use as a relatively compact, low resolution stylus printer, and will be described hereinafter with reference to that application. However, it will be appreciated that the invention is not limited to this particular use.

### Background

A number of types of electronic printers are known. For example, laser, ink jet, dot matrix tape and thermal printers are all well known within the art. Each operates in a relatively similar fashion in that they include a print head mounted within a housing. Paper or the like is fed through an opening in the housing, and drawn past the print head at a predetermined speed. The print head then prints an image onto the paper in accordance with image or text data which is usually supplied to the printer from a general-purpose computer.

### Summary of Invention

In accordance with one aspect of the present invention there is provided printing apparatus comprising:

- a body configured to be hand-held;
- an electronically controllable print head mounted on or in the body for directing printing material onto a surface according when the print head is brought adjacent thereto;
- scanning means for scanning an image to supply image data to be printed on the surface;
- position sensing means for detecting movement of the body relative to the surface;
- processor means for determining if said body has previously been moved over any point of said surface;
- wherein, as the body is moved relative to the surface, the print head directs the printing material onto the surface in accordance with the image data depending on said determination.

Preferably, the electronically controllable print head is an ink-jet print head.



In a preferred form, the body takes the form of a stylus, the print head being disposed at or adjacent the tip of the stylus and oriented such that the print material is directed away from the stylus.

Preferably, the printing apparatus further includes scanning means for scanning  
5 input image data. In one form, the scanning means is disposed adjacent the print head for scanning in a direction substantially parallel to that in which the material is directed from the print head. Alternatively, the scanning means may comprise a longitudinally extending scanning slot extending along the body, the printing apparatus being configured such that the image data is scanned through the scanning slot as the body is drawing  
10 across an existing image.

Further aspects of the invention are disclosed in the following detailed description and in the numbered paragraphs thereafter.

#### Brief Description of Drawings

Preferred embodiments of the invention will now be described, by way of  
15 example only, with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of printing apparatus according to the preferred embodiment;

Fig. 2 is a perspective view of the printing apparatus of Fig. 1 along with a docking station for use therewith;

20 Fig. 3 is a perspective view of the printing apparatus of Fig. 1 being used to scan an existing image;

Fig. 4 is a perspective view of a user applying the image scanned in Fig. 3 to his face using the printing apparatus of Fig. 1;

Fig. 5 shows the printing apparatus of Fig. 1 being used to scan a colour or  
25 texture from a pre-existing image;

Fig. 6 shows the printing apparatus of Fig. 5 being used to apply the scanned texture to a surface; and

Fig. 7 is a schematic block diagram of the printing apparatus of Fig. 1.

### Detailed Description of Preferred Embodiments

Fig. 1 shows a printing apparatus 1 formed of an elongate body 2 configured to be hand-held in a manner akin to an electronic drawing pen or stylus, as such devices are known in the graphics arts field. An electronically controllable print head 6 is mounted at a first end 8 of the elongate body 2 within a print head housing 3. The print head housing 3 includes external recharging contacts 5 to allow recharging of an internal rechargeable battery 13 via a power supply module 12 seen in Fig. 7. Position sensing means in the form of acceleration sensors 17, also seen in Fig. 7, are disposed within the elongate body 2 adjacent the print head 6.

In the embodiment of Fig. 7, the printing apparatus 1 comprises an image supply means in the form of on-board memory 11 and a processor 9 for manipulating the image data and controlling the print head 6.

In the embodiment shown in Fig. 1, the printing apparatus 1 includes a scanner 14 associated with an optical scanning slot 12 formed along the length of the body 14. The scanner 14 is located within the elongate body 2 adjacent the scanning slot 12, the scanner 14, including light sensors and the like, necessary components for optical scanning, such components being known to those skilled in the relevant art. Alternative forms of scanning, such as magnetic scanning, can also be implemented.

The elongate body 2, in the preferred embodiment, also houses the processor 9 and the on-board memory 11.

The hand-held printing apparatus 1 also includes a mode select switch 16 for selecting between printing and scanning modes. There is also provided an activation switch 18 adjacent the first end 8 of the hand-held printing apparatus 1. The switches 16 and 18 couple via a control interface 10 to cause a desired operation. The components within the body 2 may be interconnected via a common bus 19.

The hand-held printing apparatus 1 also includes a proximity sensor 15 for detecting when the print head 6 is within printing range of the surface. The proximity sensor can take any suitable form, including infra-red, ultrasonic or capacitive sensors, or one or more mechanical switches.

The printing apparatus 1 is used in a manner similar to a pen or brush. The first end 8 is held adjacent a surface on which it is desired to print an image. The print activation switch 18 is momentarily depressed, placing the printing apparatus 1 into active mode. The hand-held printing apparatus 1 is then drawn steadily over the surface. The acceleration sensors detect the relative movement of the hand-held printing apparatus 1 from its initial starting point, and controls the print head 6 to direct printing material, such as ink, onto the surface in accordance with image data stored in the memory. It will be appreciated that "image data" can include pictures, colours, two-dimensional textures and patterns, or computer generated imagery.

Usually, the printing apparatus 1, and particularly the body 2, is moved in a parallel series of strokes in a raster-like pattern. At the end of each stroke, the hand-held printing apparatus 1 is drawn back to commence a new row immediately below the preceding row printed. When completed, the parallel strips together define a complete image. Alternatively, the hand-held printing apparatus 1 can be zig-zagged across the surface to be printed or even scribbled in various combinations of zig-zag and circular strokes, until an area equivalent to the image size to be printed has been covered.

The acceleration sensors 17 track the print head 6 as it is moved relative to the surface, the resultant path being interpreted by the processor 19 and recorded in the memory unit 11. The processor 9 correspondingly tracks a position within the stored image in the memory unit 11 based on the movement of the printing apparatus 1. Whenever the printing apparatus 1 is moved across an area of the surface which has not yet been printed up on, and where the processor 9 detects that a portion of the image should be printed, the print head 6 is controlled to direct appropriate printing material onto the surface. If the printing apparatus 1 is moved across an area which has already been printed, no printing material is directed onto the surface at that point.

By adjusting the mode select switch 16, the printing apparatus 1 can be placed into scan mode, in which the scanning slot 12 is used. As best shown in Fig. 3, the printing apparatus 1 is placed on its side adjacent an image 20 to be scanned. The scanning slot 12 is positioned face down so that it is immediately adjacent the image 20.

Again, the activation switch 18 is actuated, thereby informing the hand-held printing apparatus 1 that scanning is about to commence. As the printing apparatus 1 is drawn across the image 20, the image 20 is scanned and stored in the memory unit. Once the end of the image has been reached, the activation switch 18 can be actuated again, thereby  
5 signifying the end of the scanning run. The scanned image stored in the memory unit can then be used as an image to be printed.

In a further embodiment (not illustrated), a display screen, such as an LCD, is included on the printing apparatus 1 to display the scanned image or the image selected for printing. To reduce complexity and cost, the display screen can be of relatively low  
10 resolution. In this way, an indication of the image can be provided so that the user knows which image has been scanned or selected, notwithstanding a potential lack of fine detail.

Turning to Fig. 6, the printing apparatus 1 can also be used as a writing implement such as a pen or marker. In this embodiment, any of a number of colour, line or texture styles can be selected, the styles being stored, in the preferred embodiment,  
15 within the memory unit 11. As the printing apparatus 1 is drawn across a surface, the acceleration sensors 17 measure the relative movement thereof, the processor controlling the print head 6 to reproduce the selected colour, line or texture style at a rate corresponding to the rate of movement.

In an alternative embodiment, such as that shown in Fig. 5, the first end 8 of the  
20 printing apparatus 1 includes scanning means in the form of an optical spot scanner (not shown illustrated). In this case images can be scanned strip-wise in a similar fashion to that described above in relation to stripwise printing. As with the printing mode, whenever the printing apparatus 1 is moved across an area of the surface which has not yet been scanned, the optical spot scanner is controlled to scan the surface at that point. If  
25 the optical spot scanner is moved across an area which has already been scanned, no further scanning takes place.

Alternatively, the optical spot scanner can be used as a "sampler" to sample textures or colours from an existing image or surface. For example, as shown in Fig. 5, the printing apparatus 1 is used to sample a "grass" texture 36 from an image of grass 38.



The printing apparatus 1 is then switched into print mode via mode select switch 16, and used as a writing implement. When writing, as shown in Fig. 6, the colour and texture of the grass sampled from the image is repeatedly reproduced in the form of a strip as the print head 6 moves across the surface on which it is desired to print. In a preferred form, the width of the reproduced strip can selectively be altered.

As shown in Fig. 2, a workstation 22 can be provided for use with the printing apparatus 1. In the embodiment shown, the workstation 22 includes a plurality of replacement print heads 23, respectively having fluorescent, non-toxic, and standard ink. In an alternative embodiment, a water-soluble or at least washable ink print head is provided, to allow removal of printed images from skin or other surfaces, where it is desired to make the image temporary. Also included on the workstation 22 are a number of sample textures and colours 26 which can be scanned by the spot scanner for use as line textures and colours. Finally, the workstation 22 includes a recharging point 28, into which the hand-held printing apparatus 1 can be inserted, first end 8 foremost. The charging contacts 5 abut corresponding contacts (not shown) within the recharging point 28, through which the internal rechargeable battery can be recharged. The recharging point 28 also acts as a cap for the print head 6, thereby preventing ink drying and clogging the ink jet nozzles formed therein. In a preferred embodiment, head cleaning means are provided, and can be integral to each of the heads, or can form part of the mountings for the print heads 23 or 28.

Because of its arrangement of features and way of operating, the preferred embodiments enable printing on surfaces which would otherwise be unable to be printed on by a standard printing apparatus. For example, as shown in Fig. 4, an image can be applied to the face 32 or other parts of the human body to form a fake tattoo 34. The preferred embodiments are also able to print on other solid objects, including those with curved surfaces.

In the embodiment shown, the memory unit 11 is provided for storing scanned images for later reproduction. However, the memory unit 11 can also be used to store predetermined images which are selectable by a user for reproduction through the print

head 6. In yet another embodiment (not shown) the printing apparatus 1 comprises interface means for plugging a cartridge or other image storage means onto the hand-held printing apparatus 1, thereby allowing images to be imported without data actually being transferred into the memory unit.

5 Alternatively, or in addition, the printing apparatus 1 can include data communication means in the form of infra-red or radio frequency communication, allowing the hand-held printing apparatus 1 to communicate with remote image storage means. In such an implementation, the remote image storage means takes the form of a general-purpose computer (not shown) equipped with infra-red or radio frequency  
10 transmission means. In this way, clip art or other computer-generated images stored on a computer can be downloaded selectively to corresponding infra-red or radio frequency transmission means for reproduction via the printing apparatus 1. In yet other embodiments, the data communications may simply take the form of a data cable extending between the general-purpose computer and the hand-held printing apparatus 1.  
15 Also, power can be supplied by a power cable, rather than via on-board replaceable or rechargeable batteries.

In yet other embodiments, the position sensors 17 can be replaced or supplemented by a pressure sensitive pad (or some other form of position sensing pad) upon which a piece of paper or cardboard upon which printing is to be performed, can be  
20 positioned. The pad senses the position of the print head 6 as it is moved across the surface of the paper or cardboard, and provides positional information to the processor 9 in the printing apparatus 1 by means of radio frequency communication, infra-red communication, data cable or the like. Alternatively, special paper having a visible or invisible pattern or watermark can be employed. The printing apparatus 1 includes  
25 sensors capable of detecting the relative position of the print head 6 with respect to the pattern or watermark (and thereby the paper). The hand-held printing apparatus 1 then operates in the manner described above.

In one embodiment, a porous overlay material (not shown) is employed to reduce or prevent any potential smudging of ink from the printing apparatus 1. In a preferred

form, the porous overlay material comprises a fine array of parallel capillaries, extending between opposite faces of the porous overlay material. In use, a sheet of the porous overlay material is positioned over the surface upon which the printer-apparatus 1 is to be used. Whilst the porous overlay is held in position, the printing apparatus 1 is operated as described above. Ink passes through the capillaries and is deposited on the surface. However, the ink is prevented from overspraying, smudging or spreading undesirably over the surface due to the operation of the porous overlay material. The porous overlay material also acts as a "spacer", ensuring that the print head is maintained at a predetermined distance from the surface.

In other embodiments, the printing apparatus 1 takes the form of a larger, hand-held device in which the printing material is a paint or dye. Such embodiments can be used, for example, as sign-writing devices or devices for use on fabrics and the like. These larger-scale devices can, for example, have a relatively wide linearly extending print head for printing relatively wide strips with each pass.

Preferred embodiments can also be provided with drying means for drying or curing the printing material such as ink, paints or dyes. The drying means can take the form of, for example, infra-red or other radiant heat supplying means, convective hot-air supplying means, or chemical drying or setting compositions.

In yet other embodiments, the printhead 6 can take other forms, such as a roller supplied with ink, paint, dye or the like. In the latter case, it is necessary to ensure that the printing apparatus 1 is propelled in a direction such that the roller rolls across the surface to be printed on. The ink, paint, dye or the like is supplied to an axially extending edge of the roller and is deposited on the surface as the roller rotates. Depending upon the combination of surface material, printing material and roller material, it may be necessary to provide wiping means to clean the roller of printing material after it has rolled over the surface.

Although the invention has been described in relation to a number of specific embodiments, it will be appreciated by those skilled in the art that the invention can be embodied in many other forms.

In the context of this specification, the word "comprising" means "including principally but not necessarily solely" or "having" or "including" and not "consisting only of". Variations of the word comprising, such as "comprise" and "comprises" have corresponding meanings.



**The claims defining the invention are as follows:**

1.     Printing apparatus comprising:
  - 5         a body configured to be hand-held;  
          an electronically controllable print head mounted on or in the body for directing printing material onto a surface according when the print head is brought adjacent thereto;  
          scanning means for scanning an image to supply image data to be printed on the surface;
  - 10        position sensing means for detecting movement of the body relative to the surface;  
          processor means for determining if said body has previously been moved over any point of said surface;  
          wherein, as the body is moved relative to the surface, the print head directs the
  - 15        printing material onto the surface in accordance with the image data depending on said determination.
2.     Printing apparatus according to claim 1, wherein the electronically controllable print head is an ink-jet print head.
- 20    3.     Printing apparatus according to claim 1 or 2, wherein the body takes the form of a stylus, said print head being disposed at or adjacent the tip of the stylus and oriented such that the print material is directed away from the stylus.
- 25    4.     Printing apparatus according to any one of the preceding claims, wherein the scanning means is disposed adjacent the print head for scanning in a direction substantially parallel to that in which the printing material is directed from the print head.



5. Printing apparatus according to any one of the preceding claims, wherein the scanning means includes a longitudinally extending scanning slot extending along the body, the printing apparatus being configured such that image data is scanned through the scanning slot as the body is drawn across an existing image.

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6. Printing apparatus according to any one of the preceding claims, further comprising image storage means for storing the image data.

7. Printing apparatus according to claim 6, wherein the image data scanned by the scanner is reproducible by the print head as the body is drawn across a surface.

10

8. Printing apparatus according to claim 7, wherein the print head automatically repeats printing some or all of the image data as the body is drawn across the surface.



9. Printing apparatus according to any one of the preceding claims, wherein image data corresponding to one or more line styles, colours and textures is provided for selection by a user, all or part of the image data associated with the user's selection being reproduced by the print head as it is drawn across the surface.

15



10. Printing apparatus according to any one of the preceding claims, wherein the image supply means includes a general purpose computer configured for communication with the print head.

20

11. Printing apparatus according to claim 10, wherein the general purpose computer supplies the image data to the print head via an infra-red or radio-frequency data link.

25

12. Printing apparatus according to claim 10, wherein the general purpose computer supplies the image data to the print head via a data cable.



13. Printing apparatus according to any one of the preceding claims, wherein the position sensing means senses movement of the body relative to a fixed point.

14. Printing apparatus according to any one of claims 1 to 12, wherein the position  
5 sensing device comprises one or more accelerometers for sensing movement of the body from a starting point.

15. Printing apparatus according to any one of the preceding claims, wherein the print head is selectively removable, thereby permitting replacement thereof.

10

16. Printing apparatus according to any one of the preceding claims, further comprising energy storage means disposed within the body.



17. Printing apparatus according to claim 16, wherein the energy storage means is a  
15 rechargeable battery.



18. Printing apparatus according to any one of the preceding claims, wherein the image supply means includes an image cartridge connectable to said body.

20 19. A printing apparatus according to any one of the preceding claims, said printing apparatus being configured for use with a workstation, said workstation comprising:  
an upper surface;  
a plurality of colour or texture areas disposed on the upper surface; and  
one or more docking points for releasably retaining the body.

25

20. Printing apparatus according to claim 19, wherein said workstation further comprises a plurality of detachable printing heads disposed for releasable engagement with corresponding print-head holders disposed on the upper surface of said workstation.



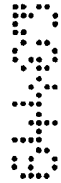
22. Printing apparatus substantially as described herein with reference to any one of the embodiment, as that embodiment is shown in the corresponding drawings.

DATED this twenty-seventh Day of February, 2002

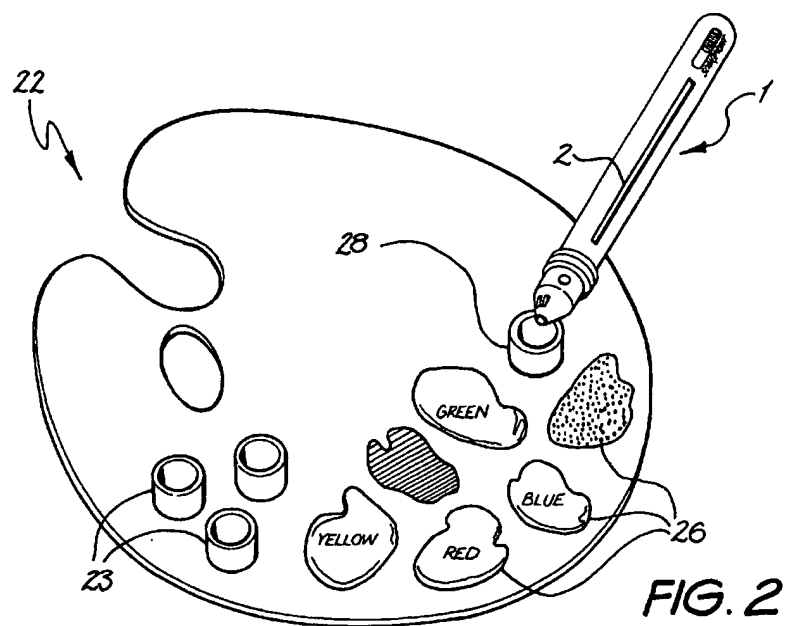
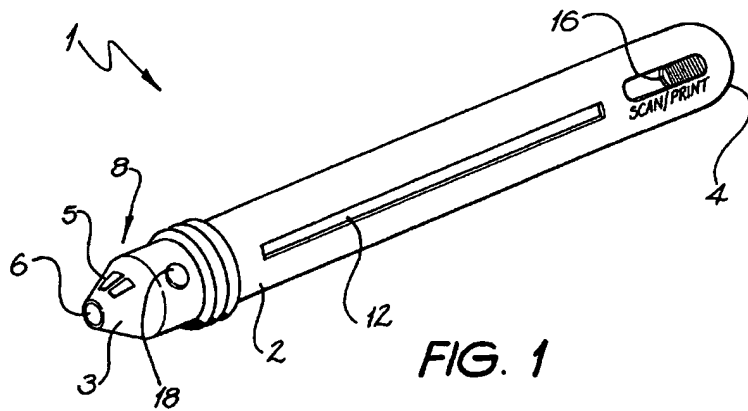
**Canon Kabushiki Kaisha**

Patent Attorneys for the Applicant

SPRUSON & FERGUSON







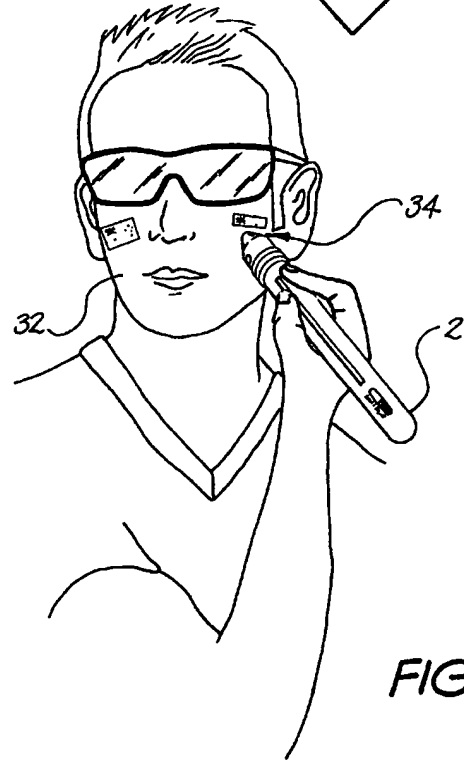
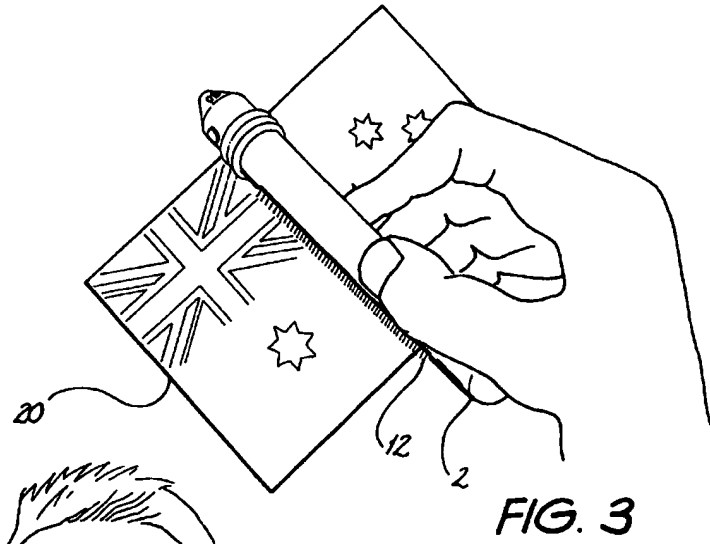


FIG. 4

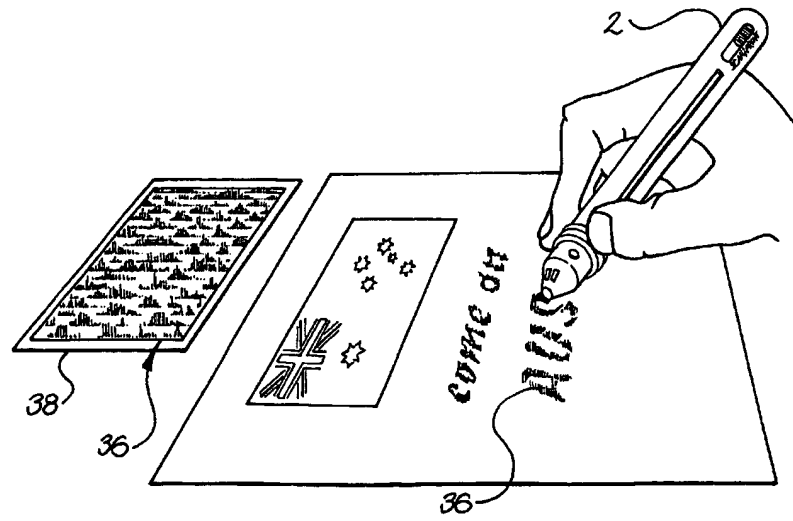
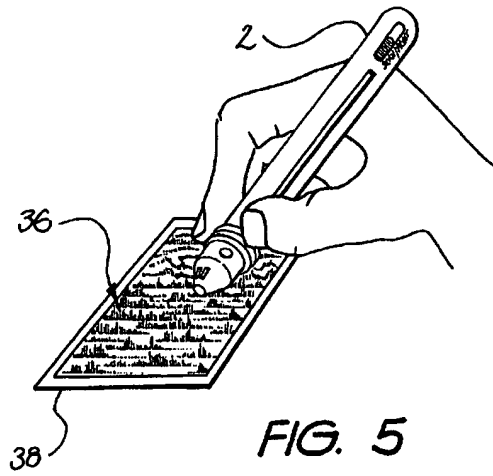


FIG. 5

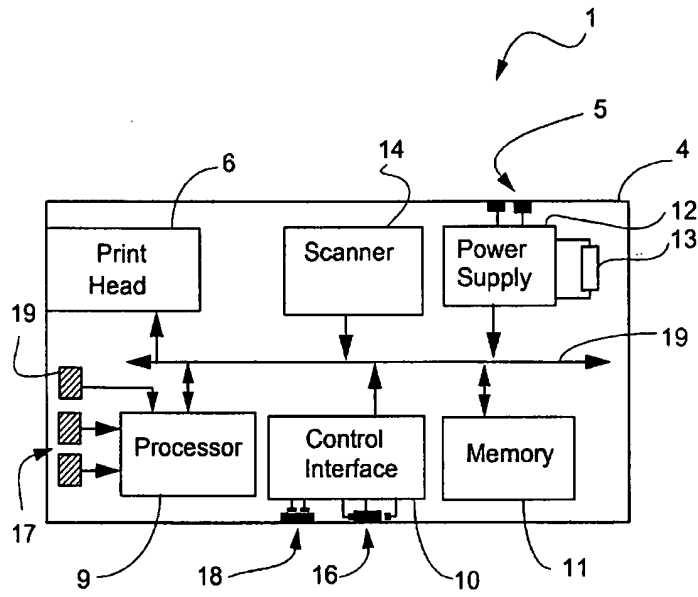


Fig. 7